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SCIENCE AND TECHNOLOGY

No. 22

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OUTLOOK FOR AUTO DESIGN IN COMING DECADE DISCUSSED

Paris LE MONDE in French 26 Feb 80 p 25

[Article by special correspondent Francois Janin: "Aerodynamics and Electronics for the Cars of the Coming Decade"]

[Text] Goteborg--How will automobiles develop during the coming decade? On this subject every manufacturer has rather specific ideas, which share the need to achieve smaller gas consumption. It is really, in large measure, energy that will decide what the automobiles of 1990 will be like.

Right now, and without knowing exactly what the future of automobiles will be, manufacturers are carrying on their research to achieve better efficiency in existing motors. Research in this regard is linked, beyond the advantage of weight, to aerodynamics and electronics--aerodynamics with the henceforth familiar aim of lessening the points of resistance on a vehicle in motion and electronics to reduce the waste of fuel as much as possible.

The experimental vehicle introduced by the Swedish Volvo Company in Goteborg is attempting to satisfy these pressing needs. Called the Volvo Concept Car (VCC) it has a good-sized body with the rear end sharply truncated. The VCC is, in fact, a body adapted to circumstances, and it owed its design only to the aerodynamic choice of the Volvo research department. In this regard, it is interesting to observe that from one wind tunnel to another the same concerns can lead to very different solutions. Thus, Renault's experimental vehicle, coded EVE (Elements for an Economical Vehicle) is by contrast very rounded and has the look of a classic automobile in three quite separate spaces: motor, driver's seat and trunk. The general shape, decisive as it may be, is not, however, all of the aerodynamic research. The slightest part of body construction can result in significant advantages, provided that it is examined properly.

Whatever may be the efficiency of the VCC's solutions, or those of any other experimental vehicle, the driver often bears the responsibility for excessive gas consumption, depending on whether or not he is heavy-footed. The increased introduction of electronics in the automobiles of the coming decade will have two effects on consumption: at first, the driver will be instantaneously informed about the consequences of his possible abuses, and then--which is the most important factor--the decision will be relayed not to step on the gas more than is necessary. The computer will guarantee to some degree the care of the motor. The substitution that will occur when these problems are perfectly mastered will give the computer on board an important role in economizing consumption.

In the VCC, the electronic equipment introduced in Goteborg provided a large amount of basic data, such as the temperature of the recooling fluids, the oil pressure, the charge of the battery, the condition of the breaks, the speed, inside or outside climatic conditions in such a way that a diagnosis of the automobile can be permanently established. All the data affecting the automobile's gas consumption are naturally offered to the driver, who thus at any moment can know his average consumption and the remaining amount of fuel. The computer also calculates the distance left to reach one's destination, the time of arrival and the possible speed adjustments necessary to arrive at the anticipated hour.

The automobiles of the 1990s will certainly satisfy some of the ideas drafted on experimental vehicles, such as the VCC. The automobiles of this decade will be lighter in any case, much more aerodynamic, and consume less energy. Propelled by gasoline, gasohol, methanol or by any other motor fuel, supercharged or not, they will always be great sources of waste, despite the outlook of improved consumption. Combustion engines, whose weak spot is that they use only a very small portion of the energy obtained, will not be replaced very soon.

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CSO: 3102

FEDERAL REPUBLIC OF GERMANY

ASSESSMENT OF RESEARCH-FUNDING POLICIES

Duesseldorf WIRTSCHAFTSWOCHE in German 14 Mar 80 pp 32-40

[Text] Research Minister Hauff's project funds are a narcotic to businessmen and a poison to the market economy, critics fear. Brooding over how and to what extent the State can appropriately promote technologies of the future has begun.

Dr Detlev Karsten Rohwedder, at one time a chartered accountant, later SPD state secretary in the Bonn economics ministry, and since the beginning of the year president of the steel concern of Hoesch Werke AG in Dortmund, was calling on old friends shortly before Christmas. At the Bonn Press Club, he met with former colleagues from the SPD fraction. FDP and CDU deputies standing nearby grinned: "Well, now he will manage again to get a few million."

What was meant to be just a joke was not at all so far removed from reality. For the construction of a new LD [Linz-Donawitz] converter steelworks with an associated continuous casting plant at the northeast edge of downtown Dortmund, which is to be finished by 1983 and is to cost about DM 550 million, Hoesch is receiving a governmental grant of DM 240 million--with an initial redemption-free period, and later the money is to be paid back at low interest and by easy installments.

And half of this subsidy is coming from the budget of the Federal Ministry for Research and Technology (BMFT), or more precisely: From Titles 68322 (Processing and Refinement of Metallic Raw Materials and Industrial Materials) and 89216 (Promotion of Nonnuclear Energy Research and Technology). With this grant for the Dortmund steel converter, the BMFT is subsidizing "three research projects which have as their aim the development and demonstrating of new technological processes in connection with the construction and operation of a steelworks," as was reported during the question period in the Bundestag last week. What is supposedly involved here is the increased use of scrap iron instead of pig iron, environmental protection techniques, and the conservation of oil.

These processes are not new. In the FRG there are at least two steelworks which already operate in this fashion. Certainly not applicable to the

Dortmund project is the BMFT's stipulation that this government aid for research is "above all aimed at promoting research and development projects which are in the national interests and whose technical-scientific risks are judged to be too high by the businesses concerned." The Hoesch steelworks would have had to be built in any case. It is scoffed in the steel trade that the sole technological innovation in connection with this project is probably the recently appointed Hoesch chief himself.

Bonn research minister Volker Hauff innocently lets affirmations be given that the allocations to the Hoesch Werke AG had "nothing to do with the person of the president." And then he made use of a well-worn but probably still effective argument which always has to do duty whenever dubious subsidies are given out: "If this plant were not constructed, the 15,000 jobs presently existing would be jeopardized."

With that, the minister is refuting himself. A year ago he used the catchwords, in an interview with the newspaper DIE WELT, that he sees himself as a "promoter for innovation." And: "Financially weak firms are not going to be assisted, just sprinters."

The fact that of all firms the footsore Hoesch Werke AG--this German-Dutch business association of Estel Hoesch-Hoogovens ended up with a loss of 288 million guilders in 1978 and is not out of the red yet--received such a nine-digit shot in the arm from Bonn has aroused furious anger in the steel industry. Its competitors Thyssen, Krupp, and Mannesmann are proud of having overcome the crisis of the recent years without subsidies. And now, complains the steel trader and president of the Federation of Chambers of German Industry and Commerce, Otto Wolff von Amerongen, "we are delivering the ammunition free to the door for the anti-dumping complaints of American steel businesses which can now be expected."

Wolff fears that the Hoesch example will utterly corrupt morals in connection with FRG research policy: "More and more businesses from industries prone to crises are seeking to tap into the research pools for grants,and then they are misappropriating such funds." Especially before elections, complains the president of the federation, attempts to ask Bonn for money are meeting with success. Right: In 2 months, elections will be held in North Rhine-Westphalia.

Lutz Stavenhagen, the spokesman on research policy for the opposition in the Bundestag and formerly a business manager in the clock and watch industry, has seen for a long time now "the boundaries between support for research and subsidies become fluid." But with the Hoesch case, he said, the government has "now discarded all inhibitions." The BMFT, he said, is behaving more and more like a "low-priced banker." According to Stavenhagen, the firms are "really almost begged to help themselves."

They have been doing this for some time already. Bonn economics minister Otto Graf Lambsdorff is complaining more and more frequently about the "come-and-get-it mentality" which is spreading among domestic businesses. In the Federal cabinet, the Liberals protested against the subsidies for Hoesch, but they only managed to get the reduction in its interest rate to be not quite so generous.

But even in an economy inclined to picking up cash, a self-stocktaking, indeed a self-criticism, is going on. In a philippic as fiery as it was crystal-clear against the research policy of this country, Werner Kleine of the Federal Association of Young Businessmen wrote in WIRTSCHAFTSWOCHE (No 47/1979): "We believe that subsidies are a drug for businessmen and that direct aid to research is the initiatory drug. The independent businesses are letting their authority be bought in little slices. In this way, the market economy is dying inch by inch."

Kleine, junior chief of the Heller Brothers Toolmakers in Achim near Bremen, admits to having himself nibbled at this drug. His firm is receiving 400,000 marks from the BMFT's Title "Humanization of Working Life" for a project called "Reduction of the Noise Pollution and Vibration Burden in Working With Electric Drill Hammers and Pavement Breakers." Klein reports that the costs for the "several months of paperwork" have eaten up these grants once again. Because of these experiences, the North German regards the direct aid practiced by the research minister as "extremely precarious and inefficient." It should "be discontinued."

Starting in 1975, when under the aegis of the present Federal finance minister Hans Matthoefer the supporting of research was expanded enormously (see graph), at that time only a few large-scale businesses were getting a share of Bonn's riches--first and foremost Siemens AG in Munich, which from time to time was receiving a half billion marks per year from the BMFT.

The large firms dazzled the officials at the research ministry with their world-famous reputations and attractive development programs. They had the know-how needed for getting money. And for the BMFT officials, it was considerably easier to grant a sum of DM 10 million once than to act on a hundred applications for 100,000 marks each.

A thing or two has changed on this score. Matthoefer's successor Hauff ("As far as product innovations are concerned, the small firms are more flexible than the large ones") is continually admonishing his assistants to pay more attention to research in the small-scale economic sector. Meanwhile, the application forms have been simplified. For smaller sums of money, the BMFT has already discontinued engaging the services of an assessor. The requests of small firms are being processed more rapidly. The research grants coming into the hands of small firms are increasing three times as fast as those for large firms.

Nevertheless, businessmen are complaining more and more vehemently about the "rampantly expanding bureaucracy" in the research ministry, "which is engaging in an extremely troublesome amount of red tape with respect to its required forms" (Werner Kleine). There is an explanation for that: There is a growing number of firms which want to apply for Bonn's money for the first time and which cannot help having difficulties in acquiring the proper application know-how.

Rudolf Biebl, management consultant in Rheinbreitbach, who has discovered a lucrative market need in showing the way to the Bonn feeding troughs to small businesses, thinks that the application procedures in the Hauff ministry are not so bad. After all, he says, the research ministry has the duty to demand records when it is contributing hundreds of thousands of marks.

If the small-scale businessmen are carping so very crossly at Bonn's research policy, surely conservative fears about any contact with the governing social liberals are also of importance. And even the displeasure of the small firms has its justification for them. And they are not the only ones who are critical. Helmut Haussmann, FDP Bundestag deputy: "Conducive to business concentration and bureaucratic." The Hamburg SPD senator for financial affairs, Juergen Steinert: "Not efficient enough."

For non-insiders, the multitude of Bonn's research programs--two dozen in all--can scarcely even be kept track of. Aside from the BMFT, almost every Federal ministry is having something researched. Even Volker Hauff says: "There are many, many grants in this country, which are very difficult to comprehend for the individual."

The Federal Association of Young Businessmen polled its members about experiences with research grants. A major portion of the questionnaires has already been returned. Initial finding: Grants for small projects are not worth the effort. The expenditure on administration costs more than the Bonn gift contributes. The break-even point, beyond which an application for assistance is generally worthwhile, lies at about DM 400,000.

The businessmen complain the most vehemently about the fact that the Bonn appropriation mills often grind only very slowly. Even for relatively small projects, it often takes a year and longer before a declaration of intent comes from the research ministry. And that is still far from being any binding promise. Therefore the opinion is growing among the small firms that the Bonn financial grants should be left alone. Direct support for research--that is, aid which is tied to individual projects--should be completely dropped. That is also what young businessman Werner Kleine from the Bremen area wants. That is what the industrial federations want. Kleine ("Mr Hauff is surely a nice man and also wants the best") proposes instead of this to intensify indirect aid given to research done in the businesses, by way of abatements in taxes.

To some extent that is already happening. In the Federal economics ministry, a program is available which has now been built up to DM 390 million, via which grants for personnel costs in the research sector are awarded. These expedients are enjoying an increasing popularity in the business world (see graph).

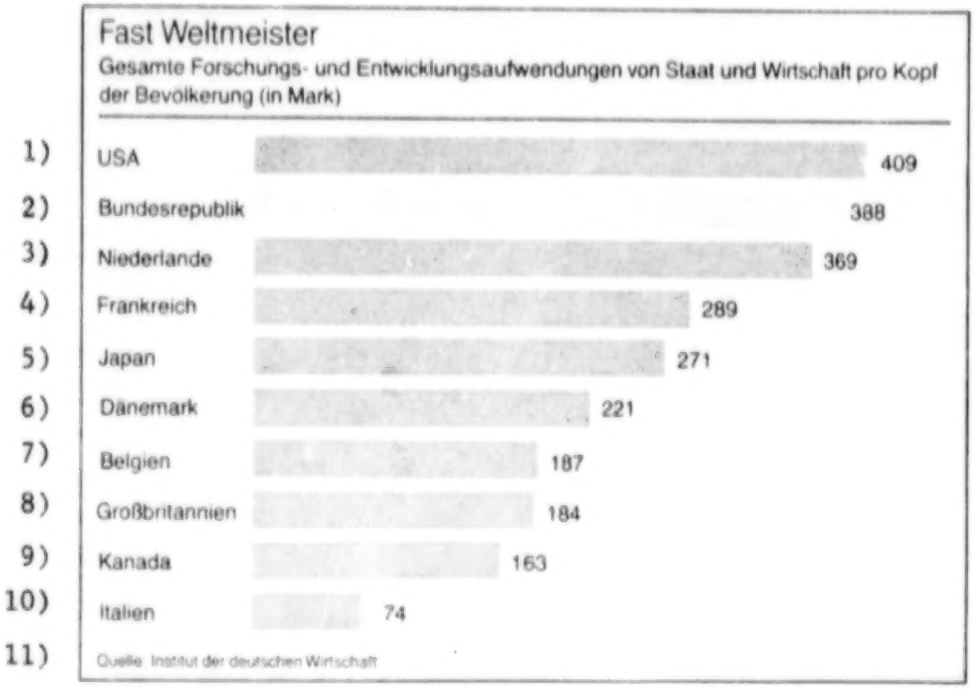
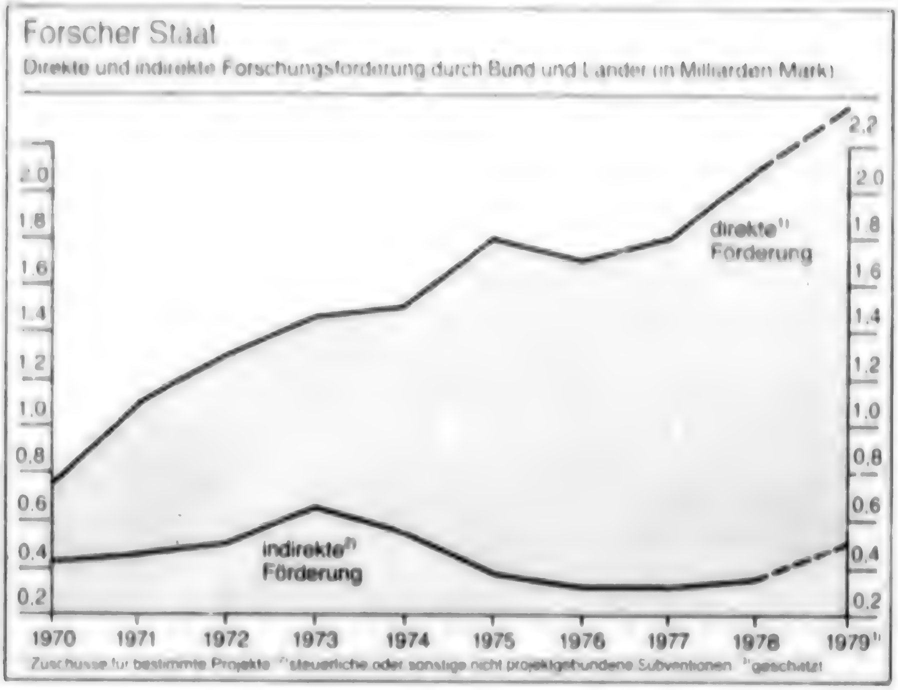


Chart: Almost World Champion. Total Research and Development Expenditures by State and Industry, per Capita of the Population (in marks)

Key:

1. United States
2. FRG
3. the Netherlands
4. France
5. Japan
6. Denmark
7. Belgium
8. Great Britain
9. Canada
10. Italy
11. Source: Institute of the German Economy



Graph: State as Researcher. Direct and Indirect Research Aid by Federal Government and Laender (in billions of marks)

Key:

direkte Foerderung--Direct aid
indirekte Foerderung--Indirect aid
1) Grants for specific projects
2) Tax or other subsidies not tied to a project
3) Estimated

Yet the Social Democrats in Bonn do not want to part with direct aid for projects. Hauff: "A third of the economy of the FRG is dependent on exports. In that area we simply cannot leave the development of new technologies to chance"--a statement which immediately aroused a fear of "governmental directing of investment" (CDU Bundestag member Stavenhagen) among members of the opposition.

Karl-Heinz Janzen, managing board member of IG Metall, also prefers to have it be direct: "Indirect research aid according to the principle of 'something for everyone' is short-winded, blind to the future, and represents nothing else than a random subsidization of profits."

Even less dogmatically-minded observers view purely general allocations as causing problems. The Munich IFO Institute for Economic Research came to the conclusion in a study it made that the large businesses are profiting disproportionately more than small-scale businessmen from allowances and write-offs for research and development (technical logogram: R + D).

There is even a CDU man who does not want to dispense with direct aid for research. Professor Eduard Pestel, minister for science and art in Lower Saxony, recalls the 1960's, when he was a member of the German Research Association. At that time he badgered Bonn Minister for Science and Research Gerhard Stoltenberg--today minister president in Kiel--to at least cough up funds for research in electronic data processing, because "otherwise we will never be able to catch up with the lead held by the Americans." As recently as in the middle 1950's, reports Pestel, FRG computer tinkerers were on the same level as their United States competition.

Pestel: "In my opinion, direct aid measures are still underrated in their effects. One should try to moderate emotions here and welcome the risk-taking by the State in those areas where it is unavoidable."

Pestel wants a "sensible coexistence" of direct and indirect aid. In addition, he wants businesses to become better acquainted with the products of thought of the advanced schools and the large research institutes such as the Max Planck Society for the Promotion of Science or the Fraunhofer Society for the Promotion of Applied Research (technical term: technology transfer).

What this Christian Democrat is speculating on publicly here is another item of German research policy which is approved of by all parties, even by the industrial associations. Professor Reimut Jochimsen, SPD science minister in North Rhine-Westphalia, describes the new inter-party credo in this way: "We must actively establish contact between the potential users and the potential producers of technological knowledge and from that point guide the line of vision of research to questions which arise in practical operation, and conversely we must interest the practical sphere in what it is that research is capable of accomplishing." In short: Technological teamwork between the advanced schools and industry is needed (see interview, page 36).

In this connection, Jochimsen would also like to get more use out of the semigovernmental Fraunhofer Society in Munich, which operates in the region of intersection of the three spheres of interest of policy, advanced schools, and industry. This institute is organizing programs for Bonn's research promotion, is keeping in close contact with the advanced schools, and thereby must earn for itself half of its revenues through research conducted under contract from industry.

The Berlin SPD senator for science, Peter Glotz, has already established a technology-transfer agency. In Baden-Wuerttemberg, the Steinbeis Foundation for Business Promotion, which is getting support from CDU economics minister Rudolf Eberle, is systematically developing a technical consultative service for businesses in the advanced schools of this Land. Bavaria's state minister for economy and transportation, Anton Jaumann (CSU), is establishing places of contact in universities for businessmen.

What is being set in motion here so euphorically in all parts of the country does not always meet with the approval of experts on this country's advanced school research. The new president of the German Research Association, the Kiel geologist Prof Eugen Seibold, wonders whether the advanced schools are still the right place for research. In foreign countries, he says, their work has had less appeal and recognition than research in institutes not connected with advanced schools.

Seibold's predecessor, the Munich nuclear physicist Prof Heinz Maier-Leibnitz, has one more thing to add: "International research can live quite well without the German contributions"--although the FRG is one of the world leaders in connection with research and development expenditures per capita (see chart).

Business consultant Biebl, a man of practical business experience, also does not believe that professors are suitable people to talk to businessmen. "Although they like to take money from industry, they hate businessmen. After all, I have seen how the professors have presented themselves as experts with the research minister and have mercilessly let small-scale manufacturers who made mistakes with their applications fall victim to the sacrificial knife."

Conversely, Biebl also does not believe that the businessmen place great value on technological advice coming from advanced schools: "None of these people really wants to admit that he does not know something. They only want money."

The government-supported technology consultation service BIT for businessmen of the Koblenz Chamber of Commerce and Industry also has something to say about this: Although there are a great many inquiries, three out of four clients are looking for only one piece of advice: How they can help themselves to the subsidy cookie jar.

PHOTO CAPTIONS

1. p 32. Large German research institute: An abundance of grants which are hard to keep track of
2. p 33. Research critic Wolff von Amerongen: Preelection crowding around the research cookie jar
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5. p 40. German advanced-school laboratory: Faulty dialog with business

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FEDERAL REPUBLIC OF GERMANY

TESTING STATION FOR INDUSTRIAL ROBOTS DESCRIBED

Bern TECHNISCHE RUNDSCHAU in German 22 Jan 80 pp 5, 7

/Article by Dr Eng Bernd Brodbeck and Eng Guenter Schiele, scientific staff members at the Fraunhofer Institute for Production Engineering and Automation (IPA) in Stuttgart/

/Text/ The possibilities of solving problems in automating machinery and in using industrial robots are being explored at the Fraunhofer Institute for Production Engineering and Automation (IPA), Stutgart, by a special working team. A test stand was designed to measure industrial robots, and to specify more precisely the use capabilities of these devices.

The use of industrial robots has risen considerably in recent years. Up to now, highly variable nomenclature was used to characterize such devices in terms of the same technical data. In other cases, the same nomenclature designates very different data.

It is therefore necessary to work out guidelines for specifying the characteristics of these devices. Such guidelines should facilitate comparison of the most diverse devices.

This paper concerns the description of a test program for industrial robots and the presentation of the most important measurement types and measurement variables. General results from measurements on various units will illustrate the comparison of different construction types.

Structure of the Test Station and Presentation of the Test Program

The industrial robot must have a precise reference to the measurement device, so that it can be measured in the entire working space and within the required accuracy range. Starting from this requirement, a test station was developed and built at the IPA, whose mechanical portion consists of a measuring plate and a three-dimensional measuring device (Figure 1).

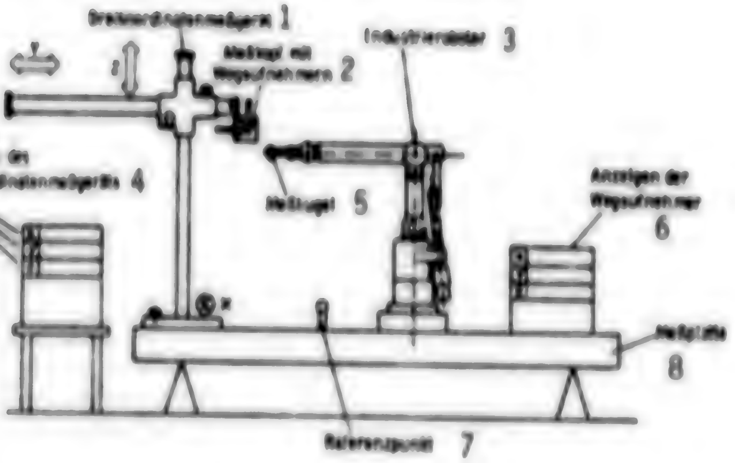

Dreikoordinatenmeßgerät 1
Meßkopf mit Wegaufnehmern 2
Industrieroboter 3
Anzeigen des Dreikoordinatenmeßgeräts 4
Meßkugel 5
Anzeigen der Wegaufnehmer 6
Referenzpunkt 7
Meßplatte 8
y
z
x

Figure 1: Test Station for Industrial Robots
Key:

1. Three-coordinate measurement unit
2. Measurement head with path sensors
3. Industrial robot
4. Display of the three-coordinate measurement unit
5. Measurement ball
6. Display of the path sensor
7. Reference point
8. Measurement plate

The measuring device can be moved on three sides of the measuring plate, the latter being used to fasten the unit being measured. A measurement head is affixed at the boom of the measuring device. It can therefore be positioned quickly and precisely in the working space of the industrial robot. Since the technical specifications of the devices being measured vary quite widely, it is suitable to develop a generally valid test program according to which the handling devices can be tested. The test program has been generated to the point that all commercial units can be included, with respect to their geometric, kinematic, and dynamical specifications (Figure 2).

The center of attention is here occupied by measurement of geometric quantities. In descriptions of these devices, these quantities have up to now been determined computationally, if they have been mentioned at all. Different values have often been used as the basis for such a calculation, and consequently comparability is not guaranteed.

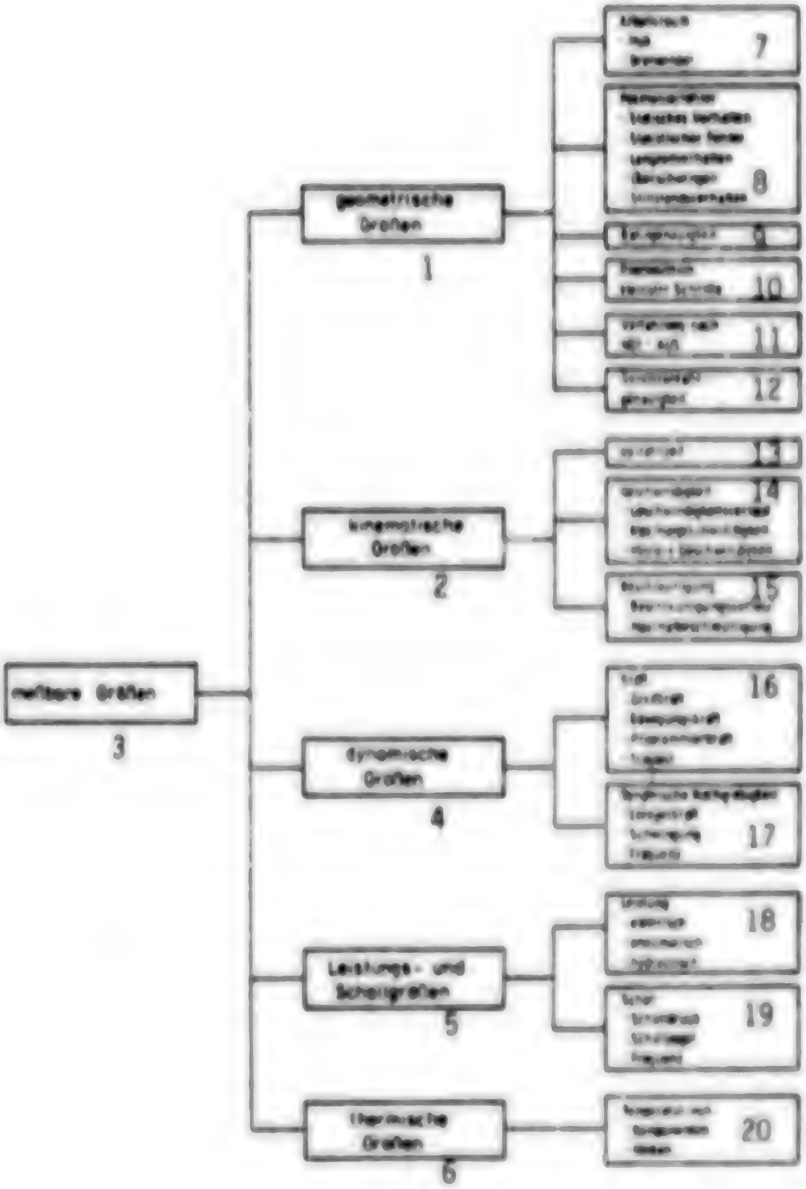


Figure 2:
Test Variables for
Industrial Robots

Key:
1. Geometric variables
2. Kinematic variables
3. Measurable variables
4. Dynamic variables
5. Power and sound variables
6. Thermal variables
7. Working space
   - Excursion
   - Turning angle
8. Positioning error
   - Static behavior
   - Statistical error
   - Long-term behavior
   - Overshoot
   - Quiescent behavior
9. Accuracy of trajectory
10. Reproduction of smallest steps
11. Displacement after emergency off
12. Synchronous running precision
13. Displacement time
14. Speed
    - Speed curve
    - Maximum speed
    - Average speed
15. Acceleration
    - Acceleration curve
    - Maximum acceleration

16. Force
    - Gripping force
    - Moving force
    - Programming force
    - Support load
17. Dynamical flexibility
    - Excitation force
    - Vibration
    - Frequency

18. Power
    - Electric
    - pneumatic
    - hydraulic
19. Sound
    - Sound pressure
    - Sound level
    - frequency

20 Temperature of
   - Components
   - Media

Measurement Methods and Results

The positional fluctuations are measured to determine the precision of the devices. This measurement is in principle performed with all units being measured. The load, strain, and speed can be varied during the measurement. By positional fluctuation is understood the deviations from a theoretical position with a prescribed number of measurements at the same measurement position. By positional fluctuation width is understood the positional fluctuation, taking into account the reversal interval, which results from approaching a theoretical position from two directions.

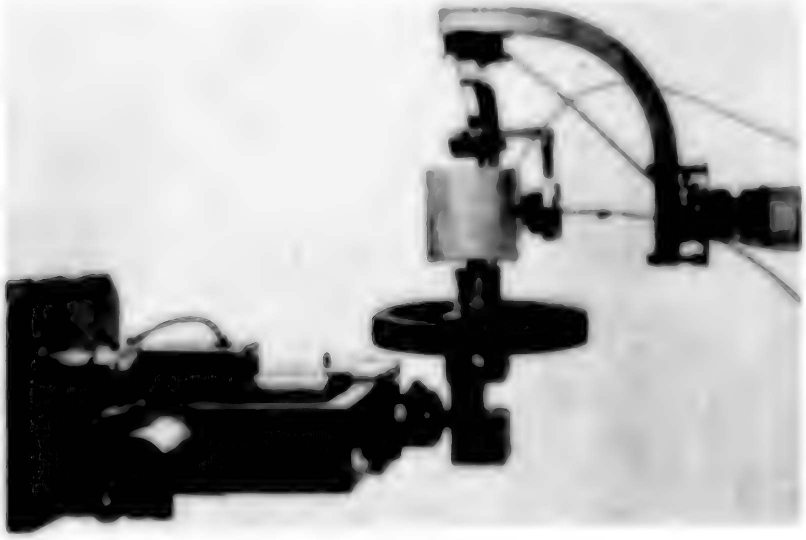


Figure 4: Contactless 3-D Measurement

Figure 4 shows a measurement head with three contactless inductive sensors. The special advantage here is that the arm of the measuring device, that is the measuring head, need not be moved, as is necessary when sensing by contact.

In principle, the present measuring method is the same as with contacting measurements. A programmed point is approached by the measuring head, and this position is assumed as the theoretical position. Subsequently, this position is approached ten times and the deviations are sensed from the theoretical position. The measured values are stored in the memory of a process computer, are processed further, the calculated values are printed out, and the deviation curve is recorded.

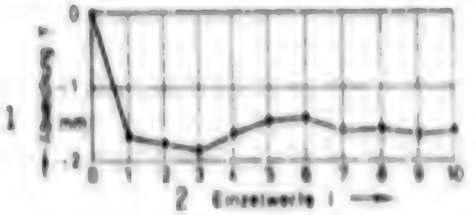


Figure 6: Positional Fluctuation With Programming After the Automatic Tracking Principle

Key:
1. Deviation y
2. Individual values i

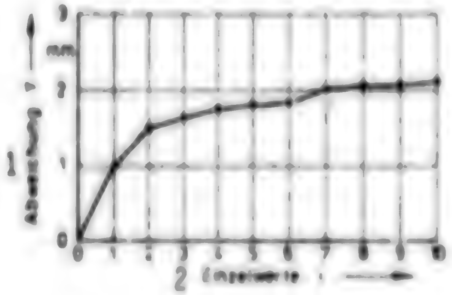


Figure 7: Positional Fluctuation of a Hydraulically Driven Industrial Robot

Key:
1. Deviation y
2. Individual values i

Figure 6 shows the typical curve for positional fluctuations of a device for lacquering, which is programmed according to the automatic tracking principle. The large deviation jump between the learning position (theoretical position) and the first automatic position (first actual position) is clearly recognizable. This jump occurs primarily because no dynamic variables act on the device during programming, because these variables are picked up by the programmer.

Figure 7 shows the basic curve of positional fluctuations with ten measurement cycles of a hydraulically driven device. A weak deviation trend is apparent, which is generally caused by temperature, although the devices were brought up to operating temperature before the measurements began. However, cooling occurs during programming and during adjustment of the measurement device. As a result, heating again takes place during the measurement cycle.

The fluctuation of the measured values lies within the tolerance range determined by calculation. This tolerance range is obtained from the resolution of the measurement systems and the load on the device. The total deviation, however, is larger than permissible. For this reason, a warm-up time should follow the programming for most devices, before the working process begins. Actual temperature errors can be corrected only once.

The long-term behavior is intended to deal with error effects due to thermal expansion. A test cycle is here traversed several times, and the final position is measured at intervals of about 10 minutes. In parallel to the geometric measurements, the temperatures at the device are recorded. In places where heat is generated, at heat transfer points, and at control points, thermocouples are affixed to sense the temperature. This guarantees continuous recording of the temperature during the entire test. The measurement series is performed over a time interval of several hours.

Figure 8: Temperature Measurement Points at an Industrial Robot "6-CH-Arm" from Cincinnati

Figure 8 shows the temperature measurement points on a hydraulic industrial robot. These measurement points are identified by glued-on numbers.

Figure 9 shows the typical temperature curve as well as the geometric deviations of the device.

The temperature rise exhibits a comparable deviation trend. Sometime after temperature stabilization, the deviation goes over into the statistical fluctuation width, which was determined with the positional fluctuation.

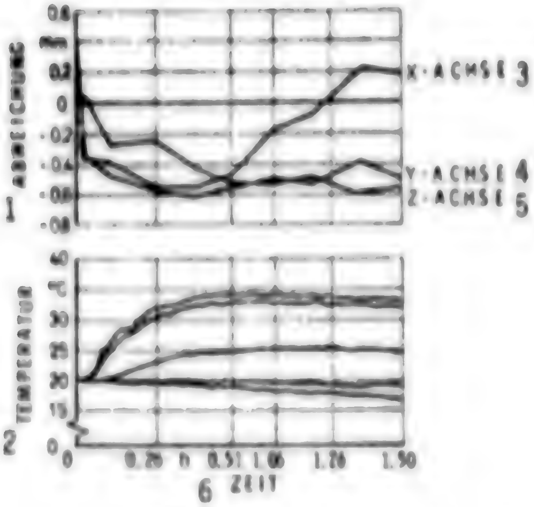


Figure 9: Temperature Curve and Positional Fluctuation
Key:
1. Deviation
2. Temperature
3. X-axis
4. Y-axis
5. Z-axis
6. Time

The warm-up time, for example, can be obtained from this measurement series. This is the time during which a device must be operated in a warm-up cycle, so that the working phase will have no or only minimal deviations because of temperature fluctuations. From measurements on several devices, the conclusion can be drawn that well-cooled driving media have a positive effect on long-term positioning, which means that the operating temperature must be lowered by an appropriate cooling device.

The overshoot of an industrial robot is sensed during its motion into its end position. The amplitude and frequency of the path signal is of interest here, as well as the time which passes until the amplitude falls below a certain prescribed permissible value.

Figure 10 is a plot of the three-dimensional vibration curve, such as occurs when running into an end point.

The vibration curve here corresponds to the basic curve of a damped oscillation. The type of run-in curve depends on the type of control. In the case of devices with control circuits for position and speed, no overshoot occurs with an optimal adjustment.

The accuracy of a unit's trajectory can be measured only for units having CP-control. Here, the two-dimensional path change is continuously sensed

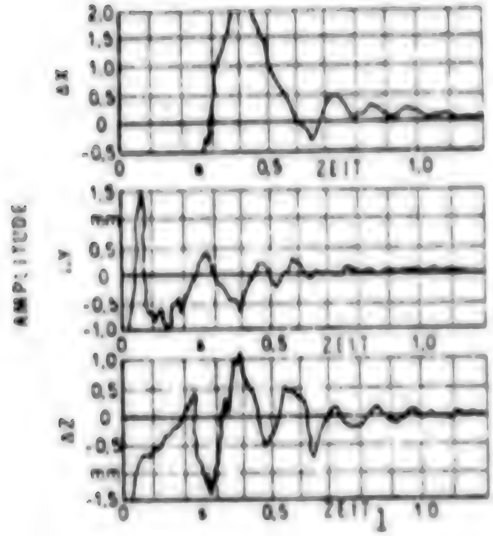


Figure 10: 3-D Oscillations When Running Into an End Position
Key: 1. Time

Figure 11: Measuring the Accuracy of the Trajectory

along a prescribed theoretical trajectory, which is represented by a four-edged ruler. Depending on the type of control, the theoretical trajectory is programmed by traversing the trajectory at a fixed distance or by programming the initial and end point.

Figure 11 shows the measurement of the actual trajectory with a contactless measurement head in 2-D design.

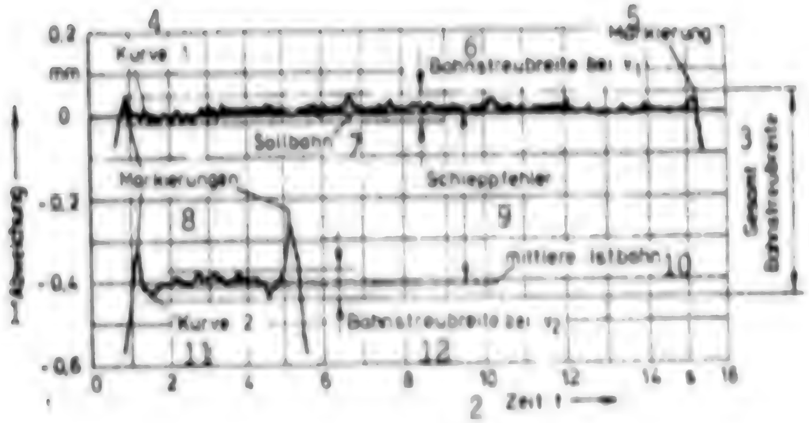


Figure 12: Accuracy of the Trajectory as a Function of Speed
Curve 1: Speed $v_1 = 0.04$ m/s
Curve 2: Speed $v_2 = 0.15$ m/s

Key:
1. Deviation
2. Time t
3. Total trajectory fluctuation width
4. Curve 1
5. Marking
6. Trajectory fluctuation width for v_1
7. Theoretical trajectory
8. Markings
9. Lag error
10. Average actual trajectory
11. Curve 2
12. Trajectory fluctuation width for v_2

During programming, the sensors are placed perpendicular to the surface of the ruler. In this way, tilts, which can occur because of the motion of the secondary axes, enter the recorded trajectory as deviations.

Figure 12 shows the curve of two trajectories with different speeds.

The curves yield both data concerning the accuracy of the trajectory, which appears as fluctuations about an average actual trajectory, and also data concerning the lag error, which is characterized by the distance between the average actual trajectory and the theoretical trajectory.

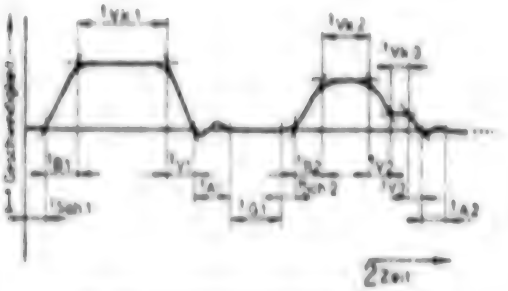
Besides the above-mentioned measurements, speed differences and accelerations are also sensed. The user can utilize these quantities, among other purposes for determining the cycle times at fixed work stations.

Figure 13 clarifies the composition of the cycle time of an industrial robot cycle.

Figure 13: Composition of the Cycle Time

Key:

1. Speed 2. Time



$$t_T = \sum_{i=1}^{n} (t_{Sch,i} + t_{B,i} + t_{V,i} + t_{A,i} + t_{G,i} + t_{Vk,i})$$

With

t_{Sch} = Switching time

t_B = Acceleration time

t_V = Delay time

t_A = Settling time

t_G = Processing or gripping time

t_{Vk} = Time at constant speed

t_T = Cycle time

n = Number of individual steps in one working cycle

It can here be clearly seen that not only the process times but also the settling times into the working positions enter into the cycle time. By controlled run-in or by run-in with reduced accuracy, the cycle time can frequently be reduced, because oscillations are avoided. When approaching intermediate positions (for example to circumvent obstacles), oscillations generally need not be considered. Besides these measurable quantities, other times also enter into the cycle time. These times derive, for example, from the dimensions of the gripper and the resulting opening and closing times. They also include switching times.

Besides the quantities described above, the measurement personnel notes whether the design is easy to operate and whether programming is convenient. This includes, for example, the programming effort as well as the possibility for subsequent program changes.

Summary

Results from measurements up to now have shown that a test station according to the present design represents a good possibility for measuring industrial robots with the required precision.

By connecting a process computer, the evaluation labor was reduced to such an extent that it is possible to measure the devices rapidly and to compare a large quantity of data, so that comprehensive information is obtainable concerning the respective characteristics of the device.

The automatic processing of measurement values also permits rapid detection of device defects during the measurement series. It thus facilitates their removal and a subsequent check by control measurements.

PROGRESS OF COAL LIQUEFACTION, GASIFICATION REVIEWED

Gasoline From Saar Coal

Graefelfing ENERGIE in German Jan 80 p 1

[Text] Already this summer, things will have advanced to the point that gasoline will flow from the coal liquefaction plant in Volklingen-Fürstenhausen (Saarland). Six tons of coal are supposed to be converted into gasoline and by-products by direct hydration. For 5 years, the Saar mines have been working on an improved method of direct hydration. From the same amount of coal, this method will generate twice as much gasoline as previous methods. Secretary of State Erwin Stahl, who was present at the completion celebration of the installation, announced that advanced planning work on several major installations for liquefying coal would already begin in January 1980.

Methane From Brown Coal

Graefelfing ENERGIE in German Jan 80 p 1

[Text] Something is happening with coal: In December, construction of another pilot plant for the hydrating liquefaction of brown coal was begun in Wesseling at Cologne. The plant is being funded by the BMFT (Federal Ministry for Research and Technology) in the amount of 111 million DM. It operates at a pressure up to 120 bar and is supposed to gasify 11 tons brown coal per hour. The resulting methane can be fed into the long-distance gas lines as a substitute for natural gas. The pilot plant is already being designed so that it can provide information about large-scale systems. A demonstration installation is anticipated as a follow-up project. This demonstration system will have an annual capacity of 5 million tons brown coal.

8348
CSO: 3102

GASIFICATION OF HOUSEHOLD REFUSE, WASTE COAL PLANNED

Graefelfing ENERGIE in German Feb 80 pp 38-39

/Text/ The same is true for houshold refuse as for ballast and waste coal: The heaps are growing; combustion is generally uneconomical and always problematical environmentally. If refuse and ballast coal are used together, the problems do not multiply but rather cancel in a certain sense. In any case, this is the promise made by an association of companies, which intends to gasify refuse and coal in a way that is both environmentally compatible and economical, by means of a technology which is as yet to be developed.

At locations in Germany where most of the ballast coal is stored, the largest quantities of refuse are also generated. These are the high-density areas around the coal regions. An association of companies, consisting of the Höleter GmbH, the Wasag-Chemie Sythen, the Bochum City Works, and the Saarberg Refuse and Power Plant Division, as well as Ruhr University in Bochum, has set as its objective to kill two unpleasant birds with one stone: Environmental compatible useful power is supposed to be generated from waste coal and refuse.

The Hölter GmbH, Gladbeck, which is supposed to function as manager of the technical team, is anticipating a step-by-step plan to achieve the lofty goal of refuse and coal gasification.

The first stage is to work out a project study for a plant to process 20 to 30 tons per day. It will cost about 1.5 million DM, to be funded by the BMI (Federal Ministry of the Interior) or the BMFT (Federal Ministry for Research and Technology). Building on these results, a pilot plant is to be erected on the property of Hölter Company or of Wasag Sythen. Planning and building time is specified at 2 years, with an expenditure of 15 to 20 million DM.

Before this step is completed, the next one is already scheduled; After only one year's operating experience with the pilot plant, the construction of a demonstration plant is anticipated in the neighborhood of existing power plants or heat power plants.

What is all this effort for? To help city governments and coal managers out of a bind. Already now it can be foreseen that refuse incineration systems will in the future only be approved with gas purification. Regardless whether purified dry or wet, such purification is expensive on the one hand and technically still problematical on the other hand. Corrosion, poor availability, and high maintenance expenditure are merely headings.

It is also known that coal gasification is difficult when coal of different quality is gasified. What to do with refuse and with the mountains of flotation coal, which grow as coal production increases? To gasify refuse and ballast coal in an environmentally compatible manner, and thereby also to provide an energy medium for firing the boilers, appears an elegant solution of the problem.

The basic outlines of the gasification of the mixed product have already been specified by the planners, and consist of three stages:

-- Processing and allocation of the refuse and of the coal

-- Pyrolysis in a swing-step reactor

-- Gasifying and removal of ash.

The first and third stage represent conventional technology, but the pyrolysis is a new idea. The plant pyrolysis reactor will be charged from outside and heated from inside. This will reduce both the heat losses and the construction length. The swing-step process (twice forwards, once backwards) is also novel with pyrolysis. In this way, the material stays in the pyrolysis reactor as long as possible and is coked with high efficiency.

If this technology can be used successfully on a large scale, not only the manufacturers of the system will profit, but the national economy will also gain: Refuse and waste coal will then be used to generate electricity and heat and will thereby relieve anthracite mining, to have available sufficient coal for refining. If the process runs as planned, its efficiency will be 10 percent higher than with separate incineration of refuse and coal - and on top of that environmentally compatible.

A first economic calculation on the part of the planners gives hope that a new energy medium will arise with the combined refuse and coal gasification.

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IKO SOFTWARE SERVICES RECEIVES GOVERNMENT SUPPORT

Cologne ONLINE in German Mar 80 pp 84-86

/Text/ In the course of information meetings at enterprises whose projects have government funding, Federal Minister of Research Dr Volker Hauff visited the Stuttgart IKO Software Service GmbH in January of this year. Friedrich A. Meyer (ADV/ORGA), in his capacity as president of the BDU, sometimes also participated in the discussion. The discussion served to present the workings of the business, and to elucidate the results of past funding. The recipients of funds also formulated the hopes and expectations of IKOSS and, in general, of small businesses with respect to the BMFT (Federal Ministery for Research and Technology).

Until the middle of last year, IKOSS was still a 100 percent subsidiary of the Kongsberg Vaapenfabrikk, which is owned by the Norwegian Government. At the present time, the capital stock (1 million DM) is held by three corporate members, one-third each. These are Dr Eng O. E. Brönlund, Chairman of the Board of the Adresens Bank, Oslo, Dr H. J. Stolz, Tax Adviser and Attorney, Stuttgart, in the name of a larger association of tax consulters and accountants, and Economist Peter Beyer, business manager of the enterprise.

In 1978, sales were around 10 million DM, and in 1979 around 16 million DM. Peter Beyer explained this large jump in sales by the expansion of the system business, that is the purchase of hardware on a greater scale. The number of employees at the end of 1979 was 70, and is supposed to increase to 80 during this year.

The main concern of IKOSS is the transfer of research to applied technology. The business here functions as intermediary between basic research and application. It works with various research institutes at universities and at the Fraunhofer Society, and it processes the programs originating there into commercially usable products for industry.

The focal point of its performances lies in the technical-scientific area. IKOSS here regards itself equally as a software house and as an engineering society. The areas of its main activity are software engineering, engineering applications (for example, programs based on using the method of finite elements), and integrated hardware and software solutions (e.g., the delivery of turnkey CAD systems).

Internationally, IKOSS collaborates with various countries and institutions. Contracts also exist with CEMA (Council for Economic Mutual Assistance) countries (e.g., a CAD computer center was delivered turnkey ready in Moscow). However, according to Beyer, sales with East bloc countries make up less than 5 percent of total sales.

Funding by the BMFT was very valuable for IKOSS. Only in this way, was it possible to remain current technically and at the same time also give small businesses access to highly developed software. Since 1973, the enterprise has received 7.2 million DM. As a subsidiary of a foreign business, IKOSS received federal funds on the condition that profits would not be transferred to the parent company.

Standard software products for the computer-supported construction and production (CAD/CAM) were particularly funded. Even after expiration of the third data processing program, IKOSS can count on federal means. However, these means will come from the "Production Engineering" program. This project is supposed to promote the introduction of EDP applications in industry.

As regards the further promotion of data processing in the Federal Republic, Research Minister Volker Hauff stated that the new program, "Information Technology," which is supposed to start this year, is in no way supposed to be a continuation of previous data processing programs of the federal government. The data processing programs have essentially achieved their objective, namely to help the German data processing industry to catch up with the international performance standard.

Since the mutual intermeshing of communication, data processing, and electronic components is increasing, this will be more emphatically considered in the new information technology program. The already agreed-upon program, "Technical Communication" was included as a component of the new program, without changing its content. The further development of electronic components (maximum integration, complex system structures) is also to be included.

It appeared especially important to Hauff to discuss the design and utilization of information technology which would fulfill human and social needs, and consequently also the funding of research and development in this area (research on consequences). Software technology will be another center of interest, so that the "transition from manufacturing operation to industrial operation" can be mastered in program development.

With the software that is being funded, independence of hardware and of the operating system should be emphasized even more than previously. The funding of applications should now only be an exceptional case.

BDU President F. A. Meyer expressed his satisfaction with the simplification of formalities for research proposals, a simplification which now has finally been achieved. This should make it easier for small and medium businesses to make applications. The application form has thus been shortened from nine to six pages and the questions are formulated more intelligibly.

Waiting for funding decisions has previously also been a handicap for medium and small businesses. They frequently could not afford to postpone the beginning of a research and development project longer than 2 to 3 months.

At the latest 3 months after the application, the BMFT is now supposed to make a decision. If the evaluation is positive, but a definitive decision has not yet been made, it is at least supposed to provide a declaration of intention.

An important feature in adhering to this schedule is the cutback in consultation by external experts. Under certain preconditions (e.g. allocation of less than 1 million DM, the recipient himself bears 50 percent of the costs of the research and development project) such consultation can be dispensed with.

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FRANCE

'BRAINPOWER' USED TO OVERCOME ENERGY SHORTAGE

Paris LE NOUVEL ECONOMISTE in French 24 Mar 80 pp 43-45

[Article by Jacqueline Giraud: "Gray Matter Versus Black Gold"]

[Text] In the absence of oil, France has to bet on its gray matter... and develop advanced technologies which will someday enable it to exploit deposits presently inaccessible.

"Once upon a time, the exploitation of oil required only muscle. Now, it requires gray matter," says Mr Francois Bernard, director of research at Elf-Aquitaine. Heartening news. In absence of oil, France is betting on its gray matter to win access to that of others. This is the direction of the "hydrocarbon program" adopted 10 January at the Elysee.

For a century, humanity has been able to exploit only the "easy" oil, that which gushed out spontaneously when a well was drilled. But with the political dangers of penury--and at the price of $30 a barrel--all oil, or almost, is going to be worth the taking: that in the great marine beds, or in the glacial ice-caps, the 70 to 80 percent of hydrocarbons which remain trapped in the bedrock of at presently exploited sites, the heavy oils, congealed bitumen, of which 300 billion tons (nearly 15 times the reserves of Saudi Arabia) is locked up in Venezuela's Orinoco zone, the 160 tons of Canadian asphaltic sands, bituminous slates, kerogenous rock--a precursor of oil--which may hold 100 billion tons of oil in the Colorado basin and more than 1 billion tons in...the Paris basin.

Slates. Even in the area of oddball oil sources, France was dealt a poor hand. In 1974, the government set up a study group on bituminous slates. Conclusion: without counting environmental problems, with a median yield of 70 liters per ton of slates, exploitation of French deposits was not profitable.

In Colorado, where the oil yield is double, production cost is estimated at a minimum of $30 a barrel. With the skyrocketing of prices, interest in the slate is reborn. Pilot projects are in progress in the United States. The French government decided on a new study on possible broad daylight exploitation of the richest slate deposits, north of the Central Massif. And, above all, it is going to launch, south of Nancy, construction of a pilot extraction plant "in situ": combustion of slates at the site "distils" the oil or produces the gas; this procedure, still very much in its infancy, would solve the environmental problems and allow exploitation of the subterranean reserves which are in excess of 1 billion tons.

Despite their past disappointments, the French oil companies are going to intensify exploration of the country's territory and continental shelf. They are expected to devote Fr. 1 billion to it in the next year, or twice the amount for last year. Recent indications in the Southwest and, even more, the spectacular Mexican discoveries show that, with progress in techniques of exploration, there is still hope for finding oil even where 50 years of drilling have uncovered nothing. The governmeht also nourishes some hope of discovering "deep" marine deposits, beyond the continental shelf, within the 10 million sq. km. of its "economic zone" around the Hexagon and the DOM-TOM (Overseas Department--Overseas Territory). The Mediterranean bottom, where oceanological expeditions have spotted saline formations often associated with oil deposits, seems particularly promising. But ways still remain to be found to work under 2,000 meters of water... This campaign of geophysical exploration and deep drilling will cost around Fr. 1.5 billion over 5 years, of which a part of the public financing will come from the hydrocarbon support fund.

This "deep" oil, if it exists, cannot be exploited with present-day off-shore technology, which is too directly derived from land-based methods: The well-heads on the surface, perched on gigantic platforms whose feet rest on the bottom. Thus, at the Frigg deposit in the North Sea, one lone concrete platform weighs 306,000 tons and measures 103 meters in height. If it is desired someday to exploit even deeper deposits, the "legs" will have to be cut off and remote controlled production wells planted directly on the sea floor, links with the surface being maintained by flexible piping. In Gabon, at the Grondin deposit, Elf-Aquitaine has tested the first automated underwater production station. After 2 years of difficulties, the station has just functioned for 6 months without incident. Starting this summer, unless Norway's new fiscal constraints kill the project, construction of a new station to exploit a small satellite deposit of natural gas near the Frigg deposit will be begun, in the Norwegian zone. "Independently of the very deep deposits, this quick solution is shown to be more economical for exploiting deposits which are otherwise too small or dispersed. In the case of the Frigg satellite (deposit), the station on the bottom will be 15 percent less costly than a fixed platform," says Mr Bernard. Several small fields in the North Sea, known but judged unprofitable, could become exploitable.

Off-shore. For a long time, thanks to the work of the French Petroleum Institute (IFP) and the efforts of CFP [expansion unknown], Elf-Aquitaine, and the para-petroleum companies, France took a leading role in the off-shore industry. But in recent years, especially in the North Sea, French enterprises ran into the growing protectionism of Great Britain and Norway. To maintain itself in this market, they must at all costs hold on to the technological lead which makes them indispensable. The "hydrocarbons program" will also focus on intensifying the development of marine technologies. While still waiting for the hypothetical riches of the French "economic zone," the oil companies have their eyes north of the 62d parallel, where Norway has just awarded exploration permits at depths of 300 to 500 meters.

"Developing advanced technologies will produce export earnings for us and also give us access to certain difficult crudes because we will know how to exploit them," explains Mr Pierre Simandoux, director of the French Petroleum Institute. This year, development of new petroleum technologies will absorb Fr. 700 million, or which 200 million will be provided by the hydrocarbon support fund. Regarding off-shore developments, the prime objective of the oil companies is to improve recovery of standard petroleum, of which one-fourth or more gushes spontaneously like an Artesian well or the overflowing of champagne. By injecting water or gas under pressure, an additional 10 percent of the reserves can be recovered. But two-thirds, at least, and more often three-fourths, remains obstinately imprisoned in the pores of the rock. Thus, when we estimate world oil reserves at some 90 billion tons (30 years of present consumption), we are writing off as a loss some 300 billion additional tons present in deposits that are known but unexploitable today. To dislodge that oil, it is not enough just to give it a push; we must change its physico-chemical nature. It can be fluidified by injection of steam, or lightened by dissolving it with carbonic gas. But the most promising solution, still experimental, consists in "washing" the deposit by injection of water with sulfonate additives. Miracle products which actually emulsify the oil. Then the large drops of oil, trapped in the pores of the rock, are liberated. In these laboratory tests, sometimes all of the oil is recovered; in the field, and taking account of economic limiting factors, it is hoped a 50 percent recovery rate can be reached, which would augment by some 90 billion tons the total of recoverable world reserves. One drawback: the sulfonates are costly, and oil produced in this way would be between $30 and $50 a barrel. Not interesting, for perhaps another year at any rate.

However, the United States, whose production is decreasing, has implemented the first of these "assisted recovery" procedures. Steam injection annually produces 10 million tons of oil in old wells in Texas and California. In France, the IFP and the two national companies began research, in conjunction with the university and CNRS [National Center for Scientific Research], in 1974. Elf already has a small pilot steam injection project at an oilfield at Lacq, and an experimental "washing" project at Chateaurenard, in the Parisian basin. But only the new price of a barrel of oil was able to justify the multiplication of pilot projects: at the French deposits of Elf, which also works in Canada and California, and Italy, in the Indonesian and Tunisian fields of CFP, whereas IFP has a project in Great Britain in cooperation with BP.

"The composition of the "sauce," or the choice of solutions, varies according to the particularities of the oil, but, with the three processes--steam, gas, chemical additives--we almost cover all the possibilities," says Mr Bertrand.

"New oil." The object of all this technological commotion is first of all to get the most out of the meager national resources. Assisted recovery could increase exploitable reserves by 15 percent, or 30 million tons. But the main goal is access, through advanced technology, to new resources outside the Middle East. For "assisted recovery" methods are also those which will allow exploitation of "new oil," especially the heavy oils of Venezuela and Canada, some 600 billion tons of reserves. "The United States has a slight lead and is well situated in these countries, but the Venezuelans want to diversify their technical cooperation," says Mr Simandoux. A cooperative accord could be signed during Mr Andre Giraud's visit to Venezuela. The IFP is already participating in the exploitation of heavy oil in Romania, while Elf-Aquitaine has a contract in Canada. In France, a steam pilot project is going to make another attempt, this year, at exploitation of the Saint-Jean-de-Marvejols deposits, in Provence, which once were highly profitable! Drilling is in progress to evaluate the importance of a new deposit at Grenade-sur-Adour: there, the oil is as thick as molasses. By dissolving it with carbonic gas, it becomes fluid enough to pump. A major drawback of this heavy oil: it is polluted with metals and various substances which are harmful to the catalyzers in the refineries. "To make it more easily transportable and capable of being processed by existing refineries, the most economical solution is to subject it to a pre-treatment at the site," says Mr Bernard. The star attraction of the new French program will be the construction of a "treatment platform" at Feyzin through the joint efforts of IFP-CFP-Elf. This platform, a veritable miniature refinery with a capacity of 20,000 tons/year, will test all pre-treatment solutions for use on heavy oils. One fortuitous spin-off for the nation: the experience acquired will facilitate the adaptation of French refineries to the new needs of the market, which will demand more and more light products and less and less heavy fuel, with the rising competitiveness of nuclear fuel and coal. The real hope: to obtain access to the fantastic heavy oil reserves by being the first to offer "pre-refining" as a solution. Tiny gray cells versus black gold.

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ITALY

NEW FIAT STRAIGHT-ALCOHOL ENGINE FOR BRAZIL

Milan IL GIORNALE NUOVO in Italian 11 Mar 80 p 4

[Article by Enrico Benzing: "With the '147,' Italian Technology Asserts Itself on the World Scene--the Alcohol FIAT Is Revolutionizing Brazil"]

> [Text] In the government's ambitious program for an alternative to oil, the Turin industry is playing the most important part. In Belo Horizonte we tried out the methanol engine. It is livelier than the gasoline engine. The real problem is to produce the fuel.

Belo Horizonte, March--The alcohol operation being carried out in Brazil to provide an alternative to gasoline as a fuel for automotive vehicles finds FIAT easily in the lead, with a version of the "147" already in use in the "fleets" of big companies, and as of 1 July next--the date fixed by the government--to be offered for sale to the public at large. The image of Italian technology is making a great leap forward both on the world scene, belabored by the energy problems, and in the Brazilian market in particular, where in 3 years, starting from nothing, FIAT has sold 300,000 vehicles, for a rate of almost 14 percent of total sales. In practice, though, we are not at the beginning of a new era for energy, and the alcohol car accounts for few of the units in a country where, despite its size, a million new vehicles enter the automotive fleet annually. Nor does the government's program for 270,000 alcohol cars in 1980, to be shared with Volkswagen, seem achievable; it will be doing well to reach even 100,000 units.

On the positive side, though, is the fact that pumps with "alcohol" designated on them are beginning to appear in the service stations of the big cities. And the government's latest stratagem, in recent days, is to induce the taxi operators to buy alcohol-powered cars right away, so as to create new stimuli. The advantages are a longer loan period (36 months instead of 18), license fee almost halved, and the possibility of finding the pumps open on Saturday and Sunday, when all the gasoline distributors (except for tourist areas) are strictly closed in Brazil.

But as regards operating costs--not to mention the fact that in the entire country only 217 of the 1,500 service stations are equipped for alcohol, and none in the south--the advantages are not such as to induce users to change over to the new fuel immediately: gasoline costs the equivalent of about 400 lire per liter here, and ethyl alcohol is sold for a little more than 200 lire, but everyone knows that the calorific power of the latter is about half, and consumption therefore turns out to be about double that of conventional fuel.

The real problem is the production of alcohol and the sales network for it: the existing facilities are not capable of a considerable increase in distillation, from either sugar cane or manioc; new growing areas should be sought out, so as not to interfere with other products of the land; and the price to the public is political at present, and one even needs a special permit card to buy alcohol.

A decisive push will come only with aggravation of the energy problem, unless the Brazilian government--which for the time being plans only for alcohol to compensate for the increases in oil consumption in the coming years--initiates a policy that gives more incentive. In any case, FIAT's diligence in this field is particularly valuable, both as pioneering technology and as a demonstration to the world of the possibilities for the use of alcohol.

In fact, the first 147 100-percent powered by this fuel was presented, on an experimental basis, to former president Geisel in 1976, upon the inauguration of the very modern Belo Horizonte establishments. In 1978 it ran a demonstration race; the next year it won the Rallye del Brasile; and now, in addition to being used by big companies, such as the telephone company, there is a fleet of 2,500 units on the road, and the 1980 program is a very full one.

The 147, as is known, is a derivation from the 127, with engine of 1,050 and 1,300 cc, and only the larger engine is used with alcohol, with compression ratio increased from 7.5 to 11.2 and with nearly identical power at 62 horsepower SAE as against 61 for the gasoline type. In mechanical terms, the modifications involve lead treatment of the fuel tank, the tubing and the various filters, chroming of the carburetor--all this related to corrosion--heated fuel lines, special pumps, different spark plugs, and a gasoline-powered system for cold-weather starting--below 10 degrees centigrade--with a small tank under the hood.

On the test course adjoining the Belo Horizonte works, I did a comparative test between two 147's just off the assembly line--one powered by gasoline and the other by methanol, and both of 1,300 cc--and the first sensation is of greater liveliness of the alcohol engine. And this is not so much because of the slight difference in maximum power (one nominal horsepower and 3 or 4 HP in practice) as because of the difference in the power curve, since there is higher effective mean pressure. Maximum speed is 144 km per hour as against 140, and acceleration from 0 to 11 km per hour was 15.1" as against 16.3", with two persons on board.

But the problem is not with performance characteristics or reliability; the problem is production of alcohol, or of the vegetable energy source of it. Brazil, with its agricultural resources, should not disappoint us.

11267
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R&D ACTIVITIES IN SWEDISH AERONAUTICS INDUSTRY

Saab, Volvo, Ericsson

Stockholm NY TEKNIK in Swedish 24 Jan 80 p 5

[Article by Sven-Olof Carlsson]

[Text] The Swedish aeronautics industry cannot convert in a short time to any alternative production to replace traditional production. Investments in civil aviation and space projects, with economic support from the state, are all that can save jobs in research and development if military orders cease. This is what the aeronautics industry's delegation said in the report recently delivered to the industry department. For this reason, the delegation recommends support to the aeronautics industry totaling 815 million kronor, primarily in the form of loans.

The delegation recommends putting only 32 million into other areas of technology. This shows clearly how the delegation feels about the possibilities of the aeronautics industry entering new areas in a short time.

The study has investigated the companies' current projects in detail and estimated their chances of becoming commercially marketable.

Alternatives Eliminated

The result has been that areas such as energy technology, environmental technology, and healthcare technology have been pretty much eliminated. It would take too long and too many resources to attempt to steer the aeronautics industry into these areas. The aeronautics industry has the wrong expertise and would face stiff competition from large, already established companies in those fields.

In the short term, only civil aviation and space technology remain. But here, too, the delegation sees great problems involved in the conversion. With military order, the aeronautics industry usually works for a single customer who can make specific requirements on the product.

Knowledge of the Market

On the civil market it is impossible to know for certain what the customer wants. Much knowledge of the market is needed, as well as great resources for marketing products--and large economic resources for investment that would yield returns only after 5, 10, or 15 years. The aeronautics industry of today is not built that way.

Transportation technology and marine technology can be long-term alternatives, especially transportation technology, which is after all the major activity at the Saab-Scania and Volvo firms. Both are attempting in various ways to gain a foothold in marine technology.

Great Resources in Space Field

In the aerospace field, even greater developmental resources are needed than for military development, in terms of both personnel and money. But here there is usually only one customer involved.

The money, the 815 million kronor, would save an average of 600 jobs in development over the next 5 years.

However, those 600 jobs correspond to only about a third of the ones that are expected to disappear during the same period. Additional jobs will be saved if the air force is able to develop and produce the SK 2 light attack plane, which was recently introduced.

Of the 815 million the delegation proposes as subsidies, Volvo Flygmotor has already been promised 138 million to support its work with the American motor manufacturer General Electric. This is for the development and manufacture of parts for a turbofan, designed primarily for the new long-distance plane, the Boeing 757 and 777.

Of the remaining 642 million, the major part would go to support projects in the fields of civil aviation and aerospace activity.

The delegation points to the Volvo-GE joint project as a prime example of when subsidies can be given.

The delegation from the aeronautics industry under the leadership of Tony Hagstrom, general director of the telecommunications department, was appointed almost a year ago. Its task has been to investigate the possibility of civil (alternative) production in the aeronautics industry--primarily at Saab-Scania's aeronautics division, Volvo Flygmotor, LME's (LM Ericsson's) MI division, SRA (Svenska Radio AB), FFA, and FFV's (Forenade fabriksverken's) maintenance division.

Saab's Aeronautics Division

Saab's aeronautics division can direct its efforts toward the following:

1. A small civil transport plane for freight or 30-50 passengers, designed for shuttle flights to larger national airports. New regulations in the United States create a good market for this type of plane. Saab has plans for such a plane and is in an advanced stage of negotiations for cooperative agreements with the American manufacturer Fairchild. In its final form, the plane will probably be a long-winged two-motor turboprop for 36 passengers, with much composite material in both the fuselage and the wings. It would provide 200 jobs in 1980 and 400 beginning in 1982 if Saab can begin the project this spring.

2. A light civil training plane, a replacement for the Safari and the Supporter. Saab has drawn up plans for two such rugged planes at the direct request of the previous government. Saab is working on the project and will present project and market studies during the spring. This could be a suitable training plane for initial military instruction.

3. Saab will coordinate the planned Swedish Viking research satellite project. The satellite will be sent up with the Ariane rocket in 1984. Saab is continuing development of Ariane's onboard computers, as well as similar work for French spot and telecom satellites. Viking and other Swedish efforts in the aerospace field would employ 200 to 270 people in developmental jobs at Saab and LM Ericsson.

4. Saab can continue to develop a system of computer-supported layout construction in electronics and machinery but will receive no support for the consultation activity or service bureau involved in such construction.

5. Saab should be subsidized to complete development of the Saab-Sub submarine to a manufactureable product.

6. Saab should receive support to develop its expertise in the civilian use of composite fibers to help the Swedish machine industry.

Volvo Flygmotor

Volvo Flygmotor can do the following:

1. The company already has agreements with General Electric to cooperate in the areas of development and subcontracting for an airplane motor and it has received state money for this purpose.

2. In the near future, Volvo Flygmotor will sign a contract with the American company Garret for relatively long-term cooperation on airplane motors, with possibilities for additional cooperation in a number of related technical areas such as power aggregates, heaters, and air conditioners. With these contracts, 70 jobs in development and 350 in production can be created.

3. The company should try to be included in future European space projects in the areas of development and production, such as for Ariane rockets. The state delegation for space activity can contribute here.

4. Volvo Flygmotor should properly define its plans for transmission systems for busses and railroad cars, as well as industrial combustion chambers, high-temperature exchangers and heat-pump systems. It should also seek state funds in traditional ways through the Board for Technical Development and the Construction Research Council.

Advice To LME, SRA, And FFV

LM Ericsson's military division in Molndal can continue the project and market studies of air traffic control radar, so-called ATC radar, that is has begun on its own. Completion of a Swedish system in this area could be worth state subsidies.

According to the delegation, Svenska Radio AB (SRA) should turn to the Board for Technical Development and the Transportation Research Delegation and seek funds for additional studies of test systems for automatic vehicle tracking and traffic control.

Forenade Fabriksverken's maintenance division will receive no special recommendations from the aeronautics industry delegation. The company is restructuring on its own toward more civilian activity.

'Super Commuter'

Stockholm NY TEKNIK in Swedish 7 Feb 80 p 32

[Article by Sven Olov Carlsson]

[Text] Saab's agreement with the American Fairchild Company to build a small civil transport plane for 30 to 50 passengers is now complete.

After long negotiations, agreement has been reached on a design aimed primarily at the future American market for shuttle planes, a real hornets nest with competition much stiffer than what Saab had previously envisioned for its nich in the civil market.

Saab-Scania/Fairchild's so-called "super commuter" plane will be a long-winged, two motor turboprop initially, ir all probability, for 36 passengers. It will have a cruising speed of around 500 km/h and a range with full load of around 1,300 km. The plane will be jointly manufactured in Sweden and the United States, but final assembly will take palce at Saab-Scania.

Shuttle Planes For American Market

Saab's previous plans for an airplane in this size category have been patterned after the Shorts 330 of Northern Ireland. Saab had envisaged a simple, rugged plane, suitable for simple, nonpermanent runways and simple airplane maintenance, useful among other things for international relief missions and difficult terrain.

Instead, the new model will be primarily a shuttle plane for the future American market. New regulations for domestic American flights have made this plane size of special interest. It is also well suited to the production plans of Fairchild's daughter company Swearingen, as a complement to the smaller Merlin II, III, and IV.

Competition With The Entire World

But now Saab and Fairchild have gotten themselves into a real hornets nest, in competition with manufacturers of smaller transport planes practically all over the world.

There are already a number of planes in and around this size class. In many cases they are designed for military use but are now rapidly being converted for civil use. The Fokker F-27 is a civil two-motor turboprop that has been sold for over 20 years and it is anticipated that it will retain its leading position for 5 to 10 years more. The Shorts 330 from Northern Ireland is selling more and more. The originally military Canadian Transporter (Saab was tricked out of the name), the Italian G 222, the Spanish Casa 212, the British BAe 748, and the 234 Boeing Chinook helicopter are competitors that are in the air today.

But the list of planned models is longer still. The American Commuter Aircraft Corporation's CAC-100 and Gulfstream's GAC-159C and GAC-616 will be domestic competitors on the American market. Many other American manufacturers of private and business planes already have models in the size class just below the "super commuter" and have plans to move up a step.

Eliminate Prototype

Other competitors on the world market will be the Canadian De Havilland DHC-8, the Brasilian Embraer EMB-120, the French Aerospatiale AS-35, and the Italian Aeritalia AIT-230. The Soviet Yak-40 with American made motors may also be a possibility.

In other words, it will be a race with a number of competitors to get their product in flying condition quickly. Aeritalia has promised to be one of the first by going directly from the full-scale model (mockup) to planes ready for delivery, without production of a prototype.

Saab's original niche for a simple, rugged plane is also being taken. Shorts has increased turnover of its model 330. Aeritalia's AIT 230 will be just such a simple, rugged plane with models for civilian and military use. The Japanese aeronautics industry is working to produce a turbojet-driven hydrofoil boat for 30 to 50 passengers, specially designed for countries consisting of islands. The hydrofoil will be capable of landing in the water or on land. And the relatively unknown Indonesian aeronautics industry is working jointly with the Spanish state-owned CASA to produce a smaller transport plane, as a continuation of the Casa 212.

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